CLAIMS:

1. An ultrasonic transmitting and receiving apparatus comprising:

an ultrasonic transducer array including plural ultrasonic transducers for transmitting ultrasonic waves and receiving ultrasonic echoes reflected from an object to be inspected;

drive signal generating means for generating drive signals for respectively driving said plural ultrasonic transducers;

transmission control means for controlling said drive signal generating means such that ultrasonic waves transmitted from said plural ultrasonic transducers form at least one ultrasonic beam;

signal processing means for performing reception focusing processing on plural detection signals obtained based on the ultrasonic echoes received by said plural ultrasonic transducers so as to form a reception focal point in at least one region within the object thereby obtaining plural detection signals relating to said at least one region;

storage means for storing plural different acoustic pressure intensity profiles set based on acoustic pressure intensity distribution formed by transmitting ultrasonic beams and the reception focusing processing to be performed in said signal processing means; and

calculating means for calculating image data relating to said at least one region on the basis of the plural detection

signals relating to said at least one region and said plural different acoustic pressure intensity profiles.

2. An ultrasonic transmitting and receiving apparatus according to claim 1, wherein said plural different acoustic pressure intensity profiles represent one of acoustic pressure intensity and acoustic pressure intensity ratios in plural regions included in an isochronal surface as a surface where ultrasonic beams reach in predetermined time elapsed from being transmitted.

3. An ultrasonic transmitting and receiving apparatus according to claim 1, wherein said transmission control means controls said drive signal generating means such that plural ultrasonic beams are transmitted simultaneously in plural directions.

4. An ultrasonic transmitting and receiving apparatus according to claim 1, wherein said signal processing means obtains plural detection signals relating to plural regions within the object, respectively;

said calculating means calculates image data relating to said plural regions by using said plural detection signals and plural acoustic pressure intensity profiles relating to said plural regions.

5. An ultrasonic transmitting and receiving apparatus according to claim 3, wherein said signal processing means obtains plural detection signals relating to plural regions within the object, respectively;

said calculating means calculates image data relating

to said plural regions by using said plural detection signals and plural acoustic pressure intensity profiles relating to said plural regions.

6. An ultrasonic transmitting and receiving apparatus according to claim 1, wherein said signal processing means obtains plural detection signals relating to one region within the object;

said calculating means calculates image data relating to said one region by using said plural detection signals and plural different acoustic pressure intensity profiles relating to said one region.

7. An ultrasonic transmitting and receiving apparatus according to claim 1, wherein said signal processing means obtains plural detection signals relating to each of plural regions within the object;

said calculating means calculates image data relating to said plural regions by using said plural detection signals and plural different acoustic pressure intensity profiles relating to each of said plural regions.

8. An ultrasonic transmitting and receiving apparatus according to claim 3, wherein said signal processing means obtains plural detection signals relating to each of the plural regions within the object;

said calculating means calculates image data relating to said plural regions by using said plural detection signals and plural different acoustic pressure intensity profiles relating to each of said plural regions.

9. An ultrasonic transmitting and receiving apparatus according to claim 1, wherein said calculating means calculates the image data by obtaining a solution of simultaneous equations which have image data relating to said at least one region as unknown and which are constructed based on the plural detection signals relating to said at least one region and plural acoustic pressure intensity profiles relating to said at least one region.

10. An ultrasonic transmitting and receiving apparatus according to claim 3, wherein said calculating means calculates the image data by obtaining a solution of simultaneous equations which have components corresponding to image data relating to said at least one region as unknowns and which are constructed based on the plural detection signals relating to said at least one region and plural acoustic pressure intensity profiles relating to said at least one region.

11. An ultrasonic transmitting and receiving apparatus according to claim 9, wherein said calculating means calculates the image data by obtaining vector "x" from an equation $Ax = b$ where "b" represents a vector having components corresponding to the plural detection signals relating to said at least one region, "A" represents a matrix having components corresponding to plural acoustic pressure intensity ratios in plural acoustic pressure intensity profiles relating to said at least one region, and "x" represents a vector having components corresponding to image

data relating to said at least one region.

12. An ultrasonic transmitting and receiving apparatus according to claim 11, wherein said calculating means obtains the vector "x" by obtaining a generalized inverse matrix of the matrix "A" which satisfies the equation $Ax = b$.

13. An ultrasonic transmitting and receiving apparatus according to claim 12, wherein said calculating means obtains the vector "x" by performing singular value decomposition on the matrix "A", reducing a rank of the matrix "A" by discarding singular values less than a predetermined value, and obtaining a generalized inverse matrix of the matrix A' which has a reduced rank.

14. An ultrasonic transmitting and receiving apparatus according to claim 11, wherein said calculating means obtains a least square solution of the vector "x" which satisfies the equation $Ax = b$ in the case where the matrix "A" have "m" rows and "n" columns where $m > n$.

15. An ultrasonic transmitting and receiving apparatus according to claim 11, wherein said calculating means obtains the vector "x" by obtaining an inverse matrix A^{-1} of the matrix "A" in accordance with one of (i) an exact method including a sweeping-out method and (ii) an iterative method in the case where the matrix "A" is a square matrix and a regular matrix.

16. An ultrasonic transmitting and receiving apparatus according to claim 2, further comprising correction means for correcting acoustic pressure intensity profiles

corresponding to a second isochronal surface based on detection signals relating to a predetermined region and acoustic pressure intensity profiles corresponding to a first isochronal surface.

17. A method of transmitting and receiving ultrasonic waves by using an ultrasonic transducer array including plural ultrasonic transducers for transmitting ultrasonic waves and receiving ultrasonic echoes reflected from an object to be inspected, said method comprising the steps of:

(a) transmitting at least one ultrasonic beam by driving said plural ultrasonic transducers;

(b) performing reception focusing processing on plural detection signals obtained based on the ultrasonic echoes received by said plural ultrasonic transducers so as to form a reception focal point in at least one region within the object thereby obtaining plural detection signals relating to said at least one region; and

(c) calculating image data relating to said at least one region on the basis of the plural detection signals relating to said at least one region and plural different acoustic pressure intensity profiles set based on acoustic pressure intensity distribution formed by transmitting ultrasonic beams and the reception focusing processing to be performed at step (b).